

Mu Iota Sigma - University of Houston Information Technology and the Human Research Facility

Margaret Klee
Lockheed Martin Space Operations
Science Engineering Analysis and Test Operation
Science and Payloads Activity



4/12/2002



Agenda

- Background
- Human Research Facility Rack 1
- Tools developed to support Life Sciences Research efforts
- Current Status

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Agenda

- Lockheed Martin Space Operations
- Human Research Facility
- Developing for Flight
- Tools developed to support Life Science Research efforts
- References

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Lockheed Martin Space Operations

- Headquartered in Washington, DC
- Employs approximately 3,800 engineers, scientists, systems analysts, and support personnel at eight National Aeronautics and Space Administration (NASA) centers, National Oceanographic and Atmospheric Administration (NOAA) command and data acquisition stations, and other locations across the country.
- Supported the U.S. space program from the days of early sounding rockets to the recent and continuing missions to service the Hubble Space Telescope and dockings with the International Space Station.

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Lockheed Martin Space Operations

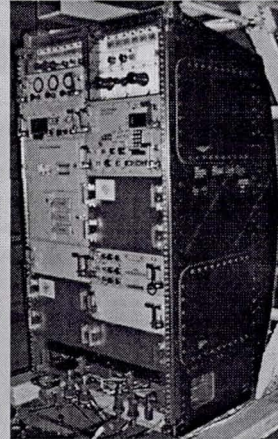
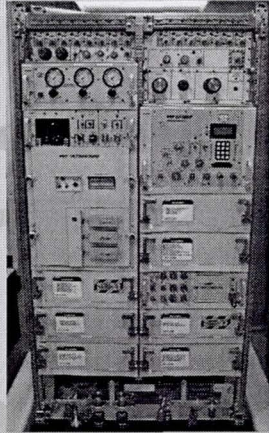
- Major programs include:
 - Consolidated Space Operations Contract (CSOC)
 - Re-engineer and commercialize NASA's space operations architecture, and provide operations, maintenance and sustaining engineering support
 - Will save NASA billions of dollars over the next nine years
 - Science, Engineering, Analysis and Test (SEAT)
 - Develop technological advances for the Space Shuttle and International Space Station programs, including robotics and simulation, and the design, develop, and manufacture of flight hardware

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Human Research Facility (HRF)



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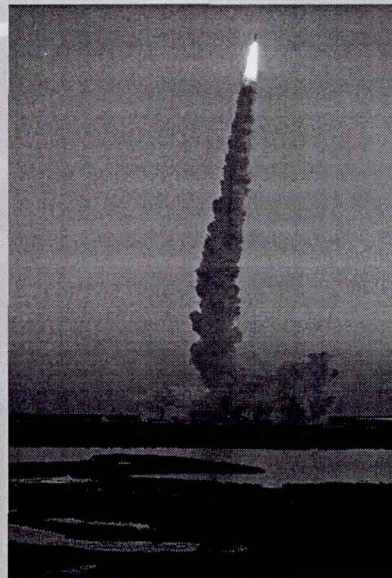
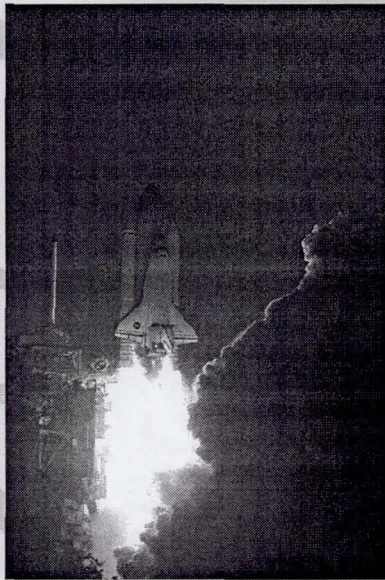
Human Research Facility

- What is it?
 - The HRF is a complement of hardware and science experiments designed to chronicle and develop countermeasures for the effects of long-duration space flight on crewmembers.
- Rack 1
 - Launched March 8, 2001
 - Activated May 18, 2001
- Rack 2
 - Scheduled for launch January 2003

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Human Research Facility

- Rack 1
 - Workstation
 - HRF PC
 - Ultrasound
 - Gas Analyzer System for Metabolic Analysis of Physiology (GASMAP)
 - Space Linear Acceleration Mass Measurement Device (SLAMMD)
 - Cooling Stowage Drawers
- Rack 2
 - Workstation
 - HRF PC
 - Pulmonary Function Module/Photoacoustic Analyser Module (PFM/PAM)
 - Gas Distribution System
 - GASMAP
 - Refrigerated Centrifuge
 - Cooling Stowage Drawers

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Human Research Facility Experiments

- Experiments are selected by NASA and International Partner organizations.
- International Space Station crew members are frequently the test subjects.
- Experiments include studies of:
 - Radiation
 - Organ function (Lung and kidney)
 - Bone loss
 - Neuromuscular systems
 - Crew interactions

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Human Research Facility

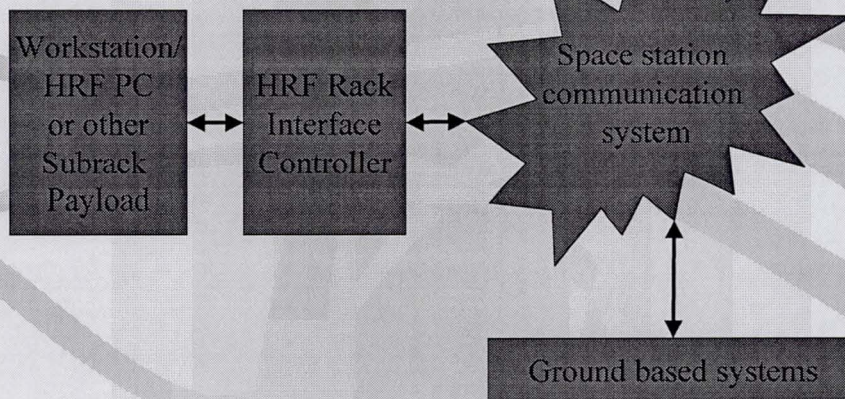
- HRF Workstation rack mounted computer
 - Pentium III, 700 MHz
 - Windows 2000
- HRF PC laptop
 - Pentium 166
 - Windows NT 4.0
- Boeing developed Rack Interface Controller
 - VME based processors
 - VxWorks

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Human Research Facility Data Architecture

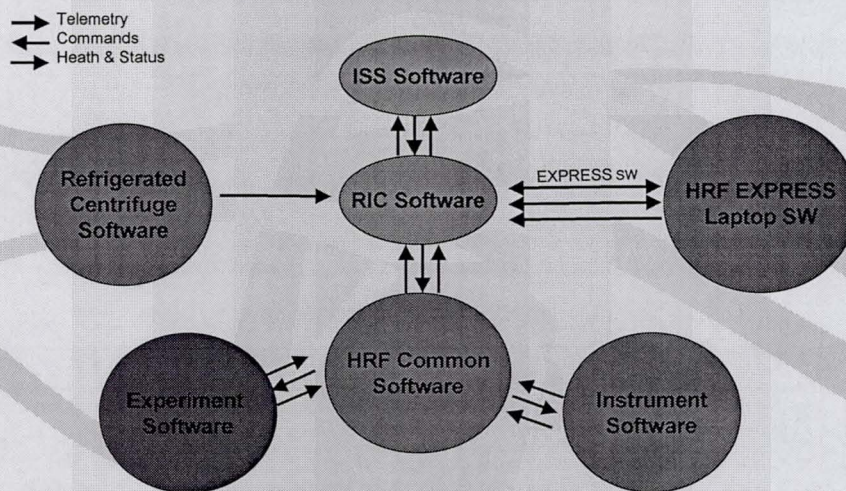


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Human Research Facility Data Architecture



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Human Research Facility Common Software

- Common Software was created
 - To provide a common interface for the crew when using HRF general purpose computers
 - To mitigate the risk associated with parallel development of the Boeing rack
 - To make it easy for experiment developers to get data to the ground with minimal software development

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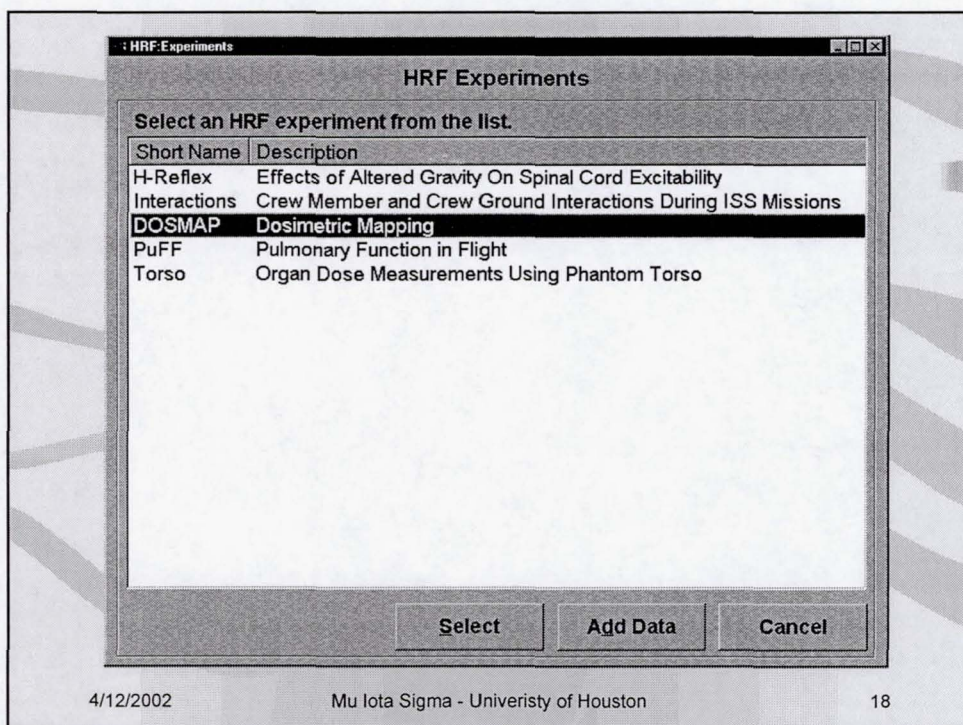
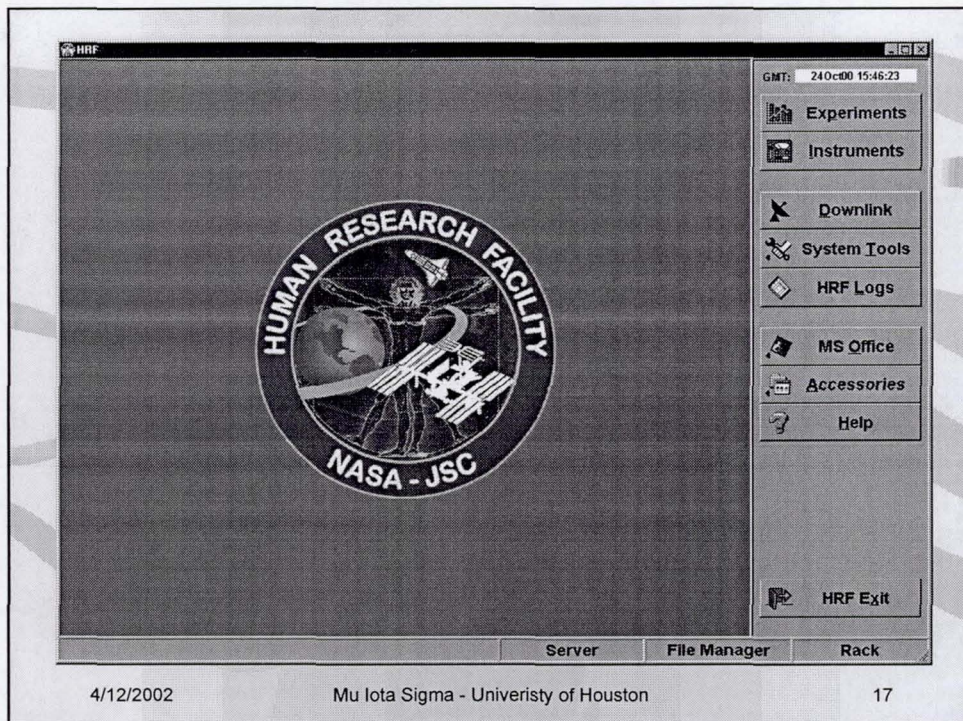
Human Research Facility Common Software

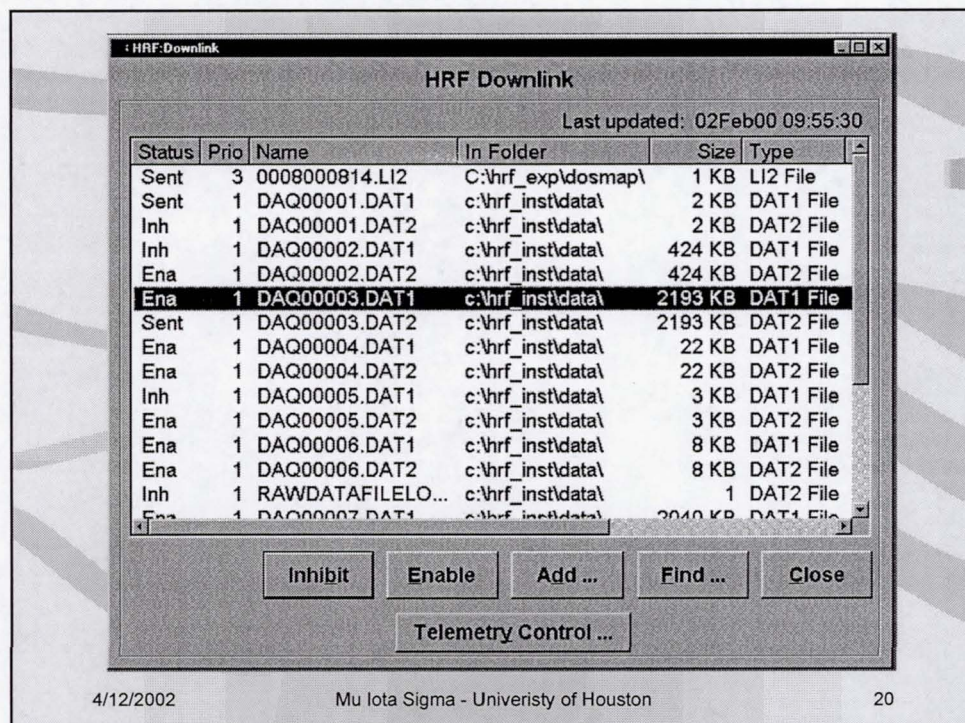
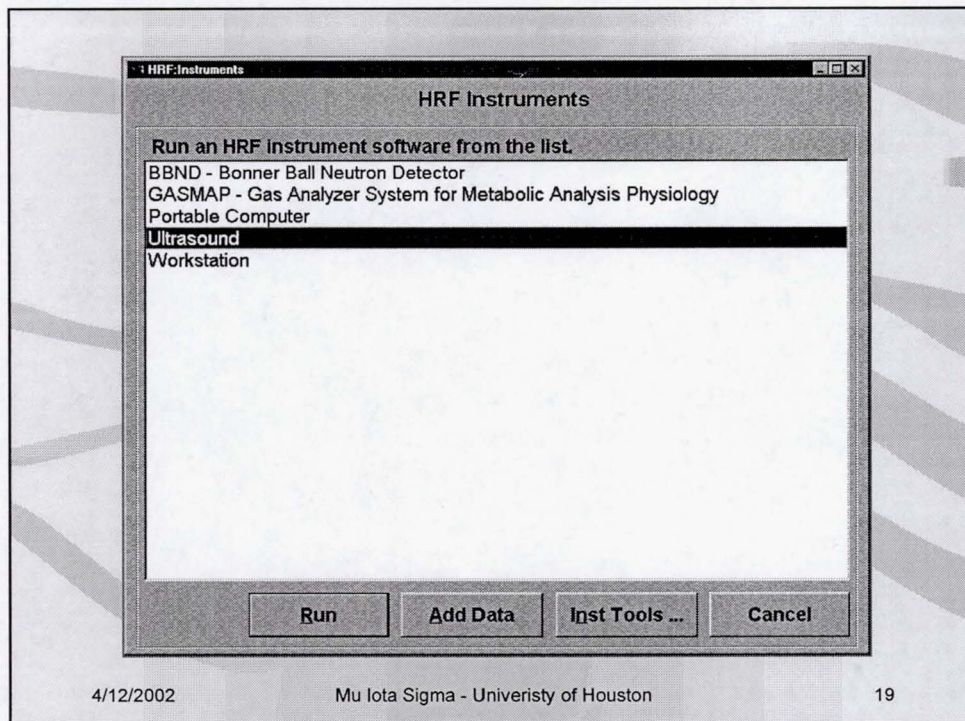
- Provides a Graphical User Interface (GUI) for the crew member to
 - Launch HRF payload software
 - View and manipulate the list of files to be downlinked
- Provides a Server interface for other payload applications
 - Real time data
 - Health and status data
- Provides a file management function

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Human Research Facility Software

- Commercial of the shelf applications used include
 - MS Office
 - Norton AntiVirus
 - Adobe Acrobat Reader
 - Netscape and Internet Explorer
 - WS FTP LE

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Developing for Flight

- Development time depends on complexity
 - Develop requirements
 - Build the hardware and software required
 - Integrate the hardware and software
 - Prove it all works together
 - Certify the system
- Can take over a year

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Developing for Flight

- Work must be performed within the constraints of the applicable quality system
- Target environment must be considered
 - Micro gravity
 - Sealed environment
 - Radiation

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Developing for Flight

- Mouse vs. Track ball
- Materials used cannot emit gasses that can poison the crew
- Newer processors are dense
 - More susceptible to radiation problems
 - Rugged packaging for military use not the same as for Space

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Human Research Facility Test and Integration Activities

- Participating in several system level tests of the US Laboratory module prior to launch
 - First payload rack installed in the US Lab
 - On the ground during tests
 - On-orbit
 - Helped identify problems with core US Lab system
 - High rate data link
 - Alarm system configurations

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Tools developed to support Life Science Research efforts

- Telescience Support Center
 - Web based tools for data display
 - Allows investigators to obtain and display data at their site
- Life Sciences Data Archive
 - Contains life sciences experiment data since 1961

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